

## Claims:

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1. Process for the production of physically foamed injection moulded articles, wherein in a first stage a propellant-free first melt portion (6) is fed into a cavity (1) (initial filling), in a second stage a physical propellant is added at elevated pressure to the following melt portion (propellant injection phase), and possibly in a third stage a propellant-free further melt portion is charged into the cavity (1), the production of the injection moulded articles occurring in the cavity, characterised in that metering of the physical propellant in the second stage occurs in a pressure regulated manner, wherein the pressure which is exerted on the propellant during the propellant injection phase is greater than the pressure which is exerted on the propellant in the phases between or before or after metered addition, and the expansion of the propellant occurs in the cavity (1).
  2. Process according to Claim 1, characterised in that the propellant is a compressible fluid.
  3. Process according to Claim 1 or 2, characterised in that the propellant is kept under pressure in the intermediate cycle times before and after the propellant injection phase, or is present in a compressed state.
  4. Process according to Claim 3, characterised in that in the intermediate cycle times the propellant is held a pressure of at least  $p_{crit}$  of the propellant at the given temperature.

5. Process according to one of the preceding claims, characterised in that the pressure exerted on the propellant is controlled via a pressure control valve (10).
6. Process according to Claim 5, characterised in that the pressure control valve (10) is a multi-way valve.
7. Process according to Claim 6, characterised in that a 3/3-way proportional valve or a 2/3-way proportional valve is used as multi-way valve.
8. Process according to one of the preceding claims, characterised in that the pressure control in the case of critical propellants additionally occurs via at least one pressure relief valve (4) which is connected downstream of the pressure control valve (10).
9. Process according to Claim 8, characterised in that the holding pressure of at least one of the pressure relief valves (4) is equal to or higher than the pressure at which a critical propellant is held in the intermediate cycle times.
10. Process according to one of the preceding claims, characterised in that the pressure preset by the pressure control valve (10) is regulated via one or more pressure relief valves (4) to the injection pressure at which the propellant is added to the melt via an injection point (5).
11. Process according to one of the preceding claims, characterised in that the injection point (5) is configured as a throttle means.

12. Process according to Claim 11, characterised in that the injection point (5) is in the form of a defined gap in an injector or of an injector with a sinter metal.
13. Process according to one of Claims 11 or 12, characterised in that the injection point (5) is configured as a controlled closure mechanism.
14. Process according to Claim 1 or one of the preceding Claims 3 to 13, characterised in that water is used as propellant.
15. Process according to one of the preceding Claims 1 to 13, characterised in that a gas or gas mixture is used as propellant.
16. Process according to Claims 15, characterised in that carbon dioxide is used as propellant.
17. Process according to Claims 16, characterised in that the carbon dioxide is held in the intermediate cycle times at a pressure of at least 60 bar ( $= p_{\text{crit}} \text{ CO}_2$  at room temperature).
18. Process according to one of the preceding claims, characterised in that for the propellant injection phase the propellant is brought to a pressure of over 60 bar via the pressure control valve (10).
19. Process according to one of the preceding claims, characterised in that a counterpressure is generated in the cavity (1).
20. Process according to one of the preceding claims,

characterised in that the physically foamed injection moulded article is selected from a handle, a knob, a gearshift knob, a steering wheel casing, a ball, a sphere, a fender, a float and a closing means for bottle-like containers.

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21. Device for the metered addition of physical propellants to a foamable melt, wherein the device comprises a storage means (11), in which the propellant is stored under pressure, a pressure control valve (10) for regulating the propellant pressure, and an injection point (5), which is configured as a throttle means, at which the propellant under pressure is fed to the melt,
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- characterised in that a controlled closure mechanism is provided at the injection point (5).
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22. Device for the metered addition of physical propellants according to Claim 21, characterised in that instead of the controlled closure mechanism or in addition to the controlled closure mechanism, at least one pressure relief valve (4) is provided.
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